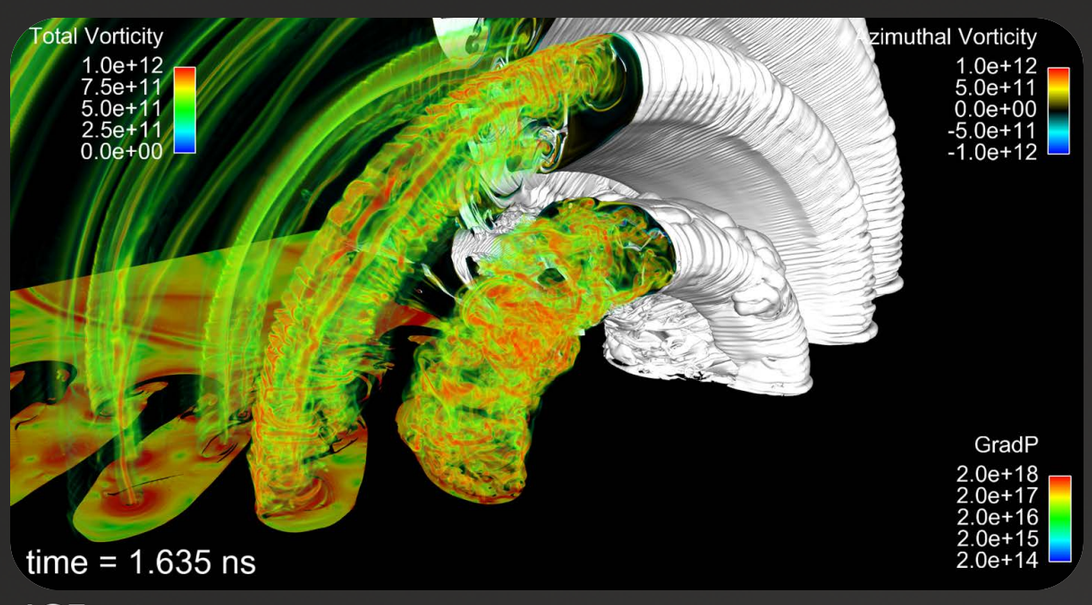
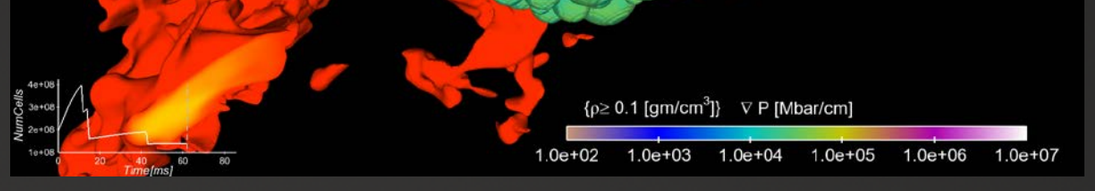
Los Alamos National Laboratory High Performance Visualization



ICF science

The above image is a time snapshot from a 3D RAGE simulation of the implosion of an Inertial Confinement Fusion (ICF) target by an asymmetric laser drive. Deviations from perfect spherical symmetry in the laser-driven implosion of ICF targets are a generic problem with laser fusion. This adaptive mesh refinement (AMR) simulation done with the RAGE code uses more than 1 billion AMR cells and achieves an unprecedented spatial resolution of 0.05 micrometers in 3D, a resolution sufficient to directly observe the mechanisms by which asymmetry in the laser drive leads to turbulent mixing of the fuel and ignition failure of the target. The white surface is the interface between the fuel and the plastic drive shell. The vortex tubes in the fuel are shown in a volume-rendered representation. The rapid evolution of the vortex tubes from an initial highly ordered state to a final fully turbulent state is readily apparent. (Images courtesy of Vincent A. Thomas and Robert J. Kares, Los Alamos National Laboratory).

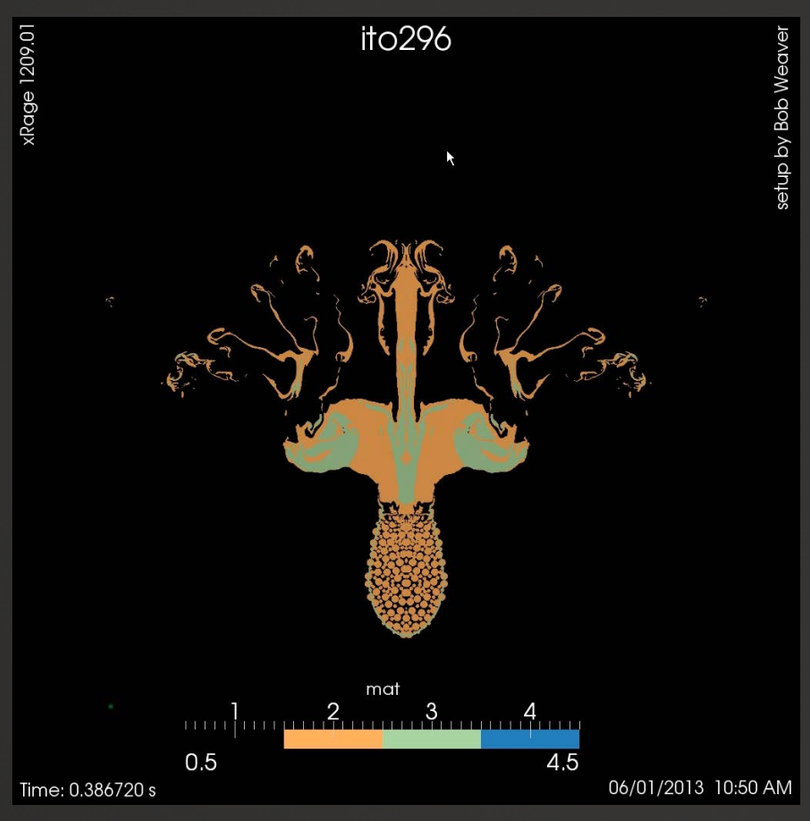


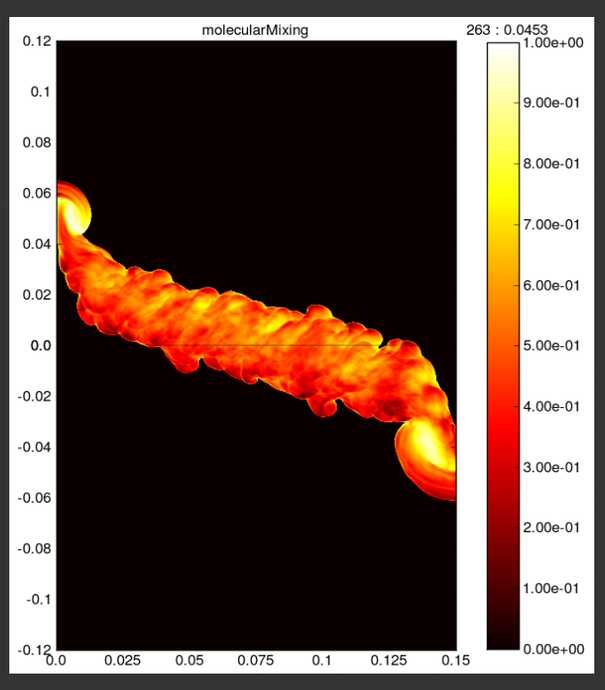
Cielo @ work: Mitigation of potential hazardous objects in space

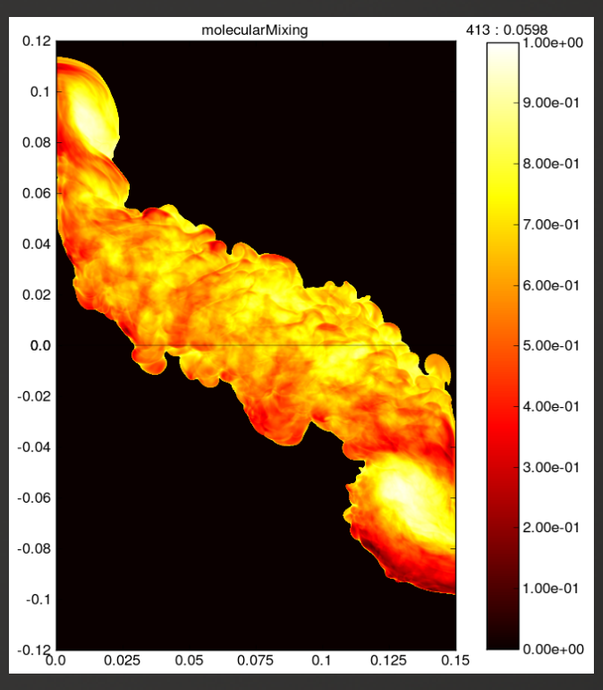
This research addresses the threat of potential hazardous objects (PHOs) in space that might collide with Earth. What you see is a non-spherical shape of the asteroid Itokawa, which is only a model and not a near-earth hazard, filled with a 'rubble pile' of spherical rocks. For this simulation, the asteroid was surrounded by a low-density gas for calculations ease. Many methods of mitigating PHOs have been proposed, including the following:

- nuclear option: explosive disruptive stand-off momentum/velocity transfer…
- non-nuclear methods: gravitational attractors, solar energy absorption…

Method: the RAGE hydro-code in 3D, with a 1-Mton energy source on the surface. Cielo is the first computer system with the processing power to allow for this problem to be run in 3D. Researcher: Robert P Weaver, XTD-6, LANL







In Situ Data Triage and Data Products

We investigate and integrate methods that automatically choose data in time and space during the runtime of a simulation that will support domain scientists in managing the time and space consumed by saving simulation results. This in situ capability which is the process of transforming data at simulation runtime has the promise of saving disk space, compute time, analysis time, producing higher fidelity results, and saving more information dense data. Work at Los Alamos National Laboratory brings together computer scientists with domain scientists and statisticians to solve these difficult problems. John Patchett, CCS-7, LANL.

Molecular Mixing

Density specific volume correlation (left) and turbulent kinetic energy (right) from DNS of titled RTI. Such data are needed for turbulence model development and validation. Daniel Livescu, CCS-2, LANL

See LANL's Stereo 3D results in the 3D Theater here in the DOE booth.

LANL ASC Visualization Facilities Update/Upgrades

LANL has upgraded the infrastructure and display systems for the Visualization Corridor in the Strategic Computing Complex (SCC) (Nicholas Metropolis Building). The Visualization Corridor is fully digital video supplying high-end graphics displays and processing power users have at their desk for 3D analysis of computed/simulated physical systems. The new Powerwall Theater Display System Upgrade provides a more robust, versatile and integrated solution where users can bring colleagues, stake holders and others together to view and discuss some of the most complex simulation data ever computed with a new ease of use. Dave Modl, HPC-5, LANL

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RESOURCE: Cielo, located at LANL and jointly operated by New Mexico Alliance for Computing at Extreme Scale, a collaboration of Sandia and Los Alamos national laboratories; ViewMaster, located at LANL.

ALLOCATION: The RAGE hydro-code in 3D, xRAGE, CEI Ensight

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U.S. DEPARTMENT OF ENERGY